

Device	XC886/888LM Series
Marking/Step	AC
Package	PG-TQFP-48/64

This Errata Sheet describes the deviations from the current user documentation. The module oriented classification and numbering system uses an ascending sequence over several derivatives, including already solved deviations. So gaps inside this enumeration can occur.

This Errata Sheet covers the following devices:

- XC886/888-6/8FF
- XC886/888LM-6/8FF

Table 1 Current Documentation

XC886/888CLM User's Manual	V1.3	Feb 2010
XC886/888CLM Data Sheet	V1.2	Jul 2009
SAA-XC886CLM Data Sheet	V1.1	Aug 2010
SAL-XC886CLM Data Sheet	V1.0	May 2010

Each erratum identifier follows the pattern Module_Arch.TypeNumber:

- **Module:** subsystem or peripheral affected by the erratum
- **Arch:** microcontroller architecture where the erratum was firstly detected.
 - **AI:** Architecture Independent (detected on module level)
 - **CIC:** Companion ICs
 - **TC:** TriCore (32 bit)
 - **X:** XC1xx / XC2000 (16 bit)
 - **XC8:** XC800 (8 bit)
 - **none:** C16x (16 bit)

- **Type:** none - Functional Deviation; '**P**' - Parametric Deviation; '**H**' - Application Hint; '**D**' - Documentation Update
- **Number:** ascending sequential number within the three previous fields. As this sequence is used over several derivatives, including already solved deviations, gaps inside this enumeration can occur.

Note: Devices marked with EES or ES are engineering samples which may not be completely tested in all functional and electrical characteristics, therefore they should be used for evaluation only.

The specific test conditions for EES and ES are documented in a separate Status Sheet.

1 History List / Change Summary

Table 2 History List

Version	Date	Remark
1.0	01.12.2006	
1.1	15.02.2007	
1.2	08.06.2007	
1.3	23.11.2007	
1.4	22.02.2008	
1.5	13.02.2009	

Table 3 Errata fixed in this step

Errata	Short Description	Chg
EVR_XC8.005	Reset toggling issue for repeated power up	Fixed
FLASH_XC8.004	Wrong data fetched during backward read-access in P-Flash with Parallel Read Mode enabled	Fixed

Table 4 Functional Deviations

Functional Deviation	Short Description	Chg	Pg
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Table 4 Functional Deviations (cont'd)

Functional Deviation	Short Description	Chg	Pg
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Table 4 Functional Deviations (cont'd)

Functional Deviation	Short Description	Chg	Pg
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Table 5 Deviations from Electrical- and Timing Specification

AC/DC/ADC Deviation	Short Description	Chg	Pg
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Table 6 Application Hints (cont'd)

Hint	Short Description	Chg	Pg
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LIN_XC8.H002	LIN Break/Synch field detection	Update	33
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PIN_XC8.H001	Current over GPIO pin must not source V_{DDP} higher than 0.3V		34
PLL_XC8.H001	Check oscillator run bit 2048 VCO cycles after oscillator run detection is restarted.		34
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SYS_XC8.H003	Effective write for Read-Modify-Write instructions of two bytes, one machine cycle	New	35
SYS_XC8.H004	Switch PLL to prescaler mode before a WDT reset	New	36

2 Functional Deviations

BROM XC8.006 IRAM data is corrupted after any warm reset

After any warm reset (i.e. reset without powering off the device), boot up via User Mode affects certain IRAM data.

The affected IRAM address ranges are:

- (1) 00_H - 07_H
- (2) 80_H - C7_H

Workaround

None

BROM XC8.010 `SYSCON0.RMAP` Switching Error

When executing from XRAM, if `SYSCON0.RMAP` is switched using an one-machine-cycle read-modify-write instruction (e.g. `ORL dir,A`) and the SFR is accessed immediately by an one-machine-cycle instruction (e.g. `MOV A,dir`) or a `PUSH` instruction, the SFR from the previous mapping might be accessed instead.

This `RMAP` switching error does not occur if code is executed from the Flash memory.

Workaround

When executing code from XRAM, use two-machine-cycle instructions to either switch `RMAP` or access the SFR. Alternatively, add one or more instructions (e.g. `NOP`) between the one-machine-cycle `RMAP` switching and SFR accessing instructions.

CD_XC8.001 Set and Clear of Error Bit in CORDIC Linear Vectoring Mode

In linear vectoring mode, the Error bit of register CD_STATC is set immediately on detecting overflow. When detected between iterations – the Error status is not held internally till the end of the calculation.

As the Error bit is defined such that it is cleared on any read access to the register (e.g. JB BSY), SW checking of the Error bit only at the end of calculation may miss to detect an overflow error condition.

Workaround

Especially in linear vectoring mode, if the error condition setting of Error bit must be detected, any read access should be done on the whole CD_STATC register (e.g. MOV) and the Error bit checked in all read instances.

CD_XC8.002 Data Fetch to CD_STATC Register may capture an incorrect error status

The error bit CD_STATC.ERROR is defined such that the bit is cleared on any read access to the register. Therefore, it is necessary to perform a data fetch on the register and check for the error bit in order not to lose the error status.

However, if the CPU inserts a wait state during the execution of the read instruction from the Flash and extends the read access by another two clock cycles, multiple read accesses will be performed on the CD_STATC register and the error bit will be cleared by the time the CPU performs the final read. As a result, the CPU does not capture the correct error status.

There is no problem if the code to read CD_STATC register is located in the XRAM.

Workaround

The following workarounds can be used to avoid incorrect data fetching from the CD_STATC register:

- The PUSH dir and POP dir instructions can be used to read the CD_STATC register in all conditions;

- The following MOV instructions can be used to read the CD_STATC register if the P-Flash parallel read mode is enabled (default) and the MOV instruction is placed on an odd address of the P-Flash¹⁾:
 - MOV Rx, dir (where x = 0...7)
 - MOV @Rn, dir (where n = 0 or 1)
 - MOV A, dir
- The following MOV instruction can be used to read the CD_STATC register if the P-Flash parallel read mode is enabled (default) and the MOV instruction is placed on an even address of the P-Flash¹⁾:
 - MOV dir, dir

INT_XC8.004 Unable to Detect New Interrupt Request if Any One of Timer 2/Timer 21/UART1 Interrupt Flags Is Not Cleared (Unexpectedly)

Note: In the current device step, the bug in Timer 2 and Timer 21 has been fixed. Therefore, the errata is applicable only to UART1.

As illustrated in the simplified figure, the UART1 interrupt flags RI and TI are combined as one interrupt request output. These flags are located within the UART1 kernel, with a single interrupt request line as output from the kernel.

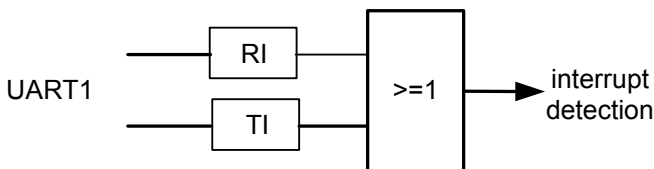


Figure 1

1) The workaround does not work if the P-Flash parallel read mode is disabled (through the parallel read disable subroutine in the Boot ROM), or if the code to read the CD_STATC register is located in the D-Flash.

Being of interrupt structure 2, the interrupt request of UART1 is detected on the rising edge of a positive pulse.

The problem is that it may occur at some point in the application, that any new UART1 interrupt request can no longer be detected after a return-from-interrupt (reti) due to service of earlier event(s). This happens when the following conditions are true:

1. UART1 events are serviced by interrupt (i.e. flags are checked and cleared only in the interrupt routine ISR),
2. Either RI or TI is set at any one time throughout the ISR (even while the other is cleared) such that at least one of the flags is still set after reti, causing the UART1 request line, which is an OR-function of the two flags RI and TI, to remain set throughout the ISR and after reti.

Two example scenerios are illustrated in the following figure:

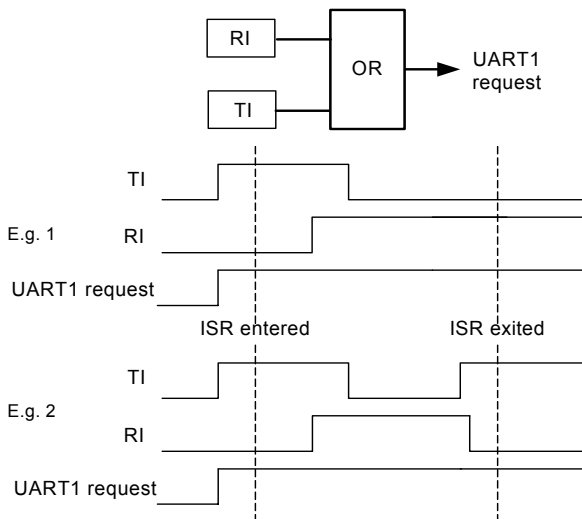


Figure 2

This means, any future UART1 RI or TI event is not able to cause a rising edge and therefore not able to trigger an interrupt request to the core – as if the UART1 interrupts had been disabled, until both RI and TI flags are cleared at some time. The clearing of flags would have to be done by user's code

additionally outside of the UART1 interrupt routine, which is however normally not feasible with an interrupt service scheme.

Note: This condition affects only the detection of UART1 interrupt events RI and TI. It does not block the detection of other interrupt events belonging to the same interrupt node.

Workaround

There are two suggested workaround:

1. If other events of interrupt node XINTR8 (EX2) need not be enabled for interrupt, disable this interrupt node and use software polling of the flags instead.
2. Before return from interrupt, check again if RI or TI is (still) set (due to new request since the last check). If so, jump and execute the ISR routine from start. Exit only when all flags are checked to be cleared. However, dummy interrupt of the node may occur after return from interrupt, and should be ignored. Another drawback is if UART1 events are occurring at high rate, the CPU may be 'stuck' in the service routine of the UART1 interrupt for a long time.

<entry point of interrupt node service routine>

.....

Start:

check flag RI

.....

clear flag RI

.....

check flag TI

.....

clear flag TI

.....

Finish:

if RI or TI is set, jump to Start

reti (return from interrupt)

Figure 3

Note: The Boolean CLR and CPL instructions cannot be used to clear RI and TI bits of UART1. Refer to UART_XC8.001.

INT_XC8.005 Write to IRCON0 Blocks Interrupt Request of External Interrupt 0,1

Any write (read-modify-write or direct MOV) to the SFR IRCON0 will block an incoming interrupt request from external interrupt 0 or 1, even though the respective flag (EXINT0 or EXINT1) is set.

Workaround

After any write to the IRCON0, check (read IRCON0) the flags EXINT0 and EXINT1. If any flag is set, run the service routine; otherwise proceed.

In case of enabled for interrupt, the service routine should be duplicated: one copy as the interrupt service routine (with reti executed); another copy in main code memory for software call (with ret executed).

LIN_XC8.001 Fast LIN BSL does not support baud rate of up to 115.2 kHz

Fast LIN BSL supports only a baud rate of up to 57.6 kHz and not up to 115.2 kHz as described in the user's manual.

Workaround

None

OCDS_XC8.008 Watchdog Timer behavior during Debug with Suspend

The WDT may be enabled for suspend (stops counting) in debug mode.

In this suspended state, when the WDT is refreshed by writing WDTCON.WDTRS, the timer base counter which provide the clock to WDT is not refreshed to zero.

The effect is that on exiting Monitor Mode in user mode, the WDT may count a little shorter to overflow. This shortened time is less than one WDT count.

Workaround

None. This WDT behavior occurs only during debug where WDT is enabled for suspend.

PIN_XC8.005 Glitches on TCK when switching between clock sources

The JTAG clock input, TCK, has multiple sources; two in XC886 variants (P0.0, P2.0) and three in XC888 variants (P0.0, P2.0, P5.6). Unexpected glitches may occur when the clock source is switched from:

1. P0.0 to P2.0; or
2. P2.0 to P0.0; or
3. P5.6 as a normal GPIO pin to TCK.

These glitches may potentially bring the system into an undefined state.

Workaround

To prevent the occurrence of such glitches during the clock switching, the following 2 workarounds are proposed:

1. The user has to follow a specific sequence when carrying out any of the above clock switching. When switching from P0.0 to P2.0 or vice versa, the user must first switch the clock source to P5.6 before proceeding to switch to the desired clock source. Similarly, when switching P5.6 from a normal GPIO pin to TCK, the user must first assigned TCK to either P0.0 or P2.0 before switching from this clock source to P5.6. (Valid only for XC888 variants)
2. The user has to configure all the TCK pins as input and drive them to either all zero or all one before switching the clock source from one pin to another.

PIN_XC8.006 Port 4 pads (excluding P4.2) toggle once upon a power-on or hardware reset

All Port 4 pads, excluding P4.2, are stated to have Hi-Z as the reset state. However, these pads are pulled up internally when a power-on or hardware reset is asserted. They are returned to the Hi-Z state with internal pull-ups

disabled only after the reset is deasserted. The result is that these pads toggle once upon a power-on or hardware reset.

Workaround

There are two proposed workarounds:

1. Implement external pulls on the external circuitry to prevent the toggle of the Port 4 pins. In case low level is required, strong external pull-downs (in the range of 2 k Ω to 3 k Ω) must be used.
2. Use alternate pins of the same function from the other ports. For example, for motor control applications which make use of the CCU6 output pins, Port 3 pins can be used instead.

PIN_XC8.007 External pull-up device is required on MBC pin to enter user mode

Although MBC pin is specified to be pull-up in the reset state, an external pull-up device is still required to enter user mode.

Workaround

Implement external pull-up (in the range of 4.7 k Ω to 100 k Ω) on the external circuitry for MBC pin. Alternatively, MBC pin could be tied to high.

PM_XC8.003 Wake-up triggered before power down sequence completed

Setting the PD bit in PMCON0 register will cause the device to go into power down mode. When this bit is set, flash memory will start the powered down sequence immediately. If a wakeup event happens before flash powers down completely, the device will not be able to wake-up normally. The flash memory requires the following maximum time to complete power down:

- 160 usec if the flash is in program or erase mode
- 350 nsec if the flash is in read or idle mode

Workaround

None.

SYS_XC8.001 MOV (direct, direct) instruction might cause a wrong value to be written to the destination register

The MOV (direct, direct) instruction (hex code 85_H) that access registers (direct address ranging from 80_H to FF_H), does not write the correct value of the source register to the destination register if the destination register is a register listed in the table below.

The source register can be any register from the direct address range 80_H to FF_H.

Table 7

Module	Register	SFR Address	RMA P	Page	Products Affected
SCU	IRCON0	B4 _H	0	0	XC88x, XC878
	IRCON1	B5 _H	0	0	XC88x, XC878
	IRCON2	B6 _H	0	0	XC88x, XC878
	IRCON3	B4 _H	0	3	All
	IRCON4	B5 _H	0	3	All
	NMISR	BC _H	0	0	XC88x, XC878
	FDCON	E9 _H	0	0	XC88x, XC878
	PMCON0	B4 _H	0	1	XC88x, XC878
	OSC_CON	B6 _H	0	1	XC88x, XC878
	PLL_CON	B7 _H	0	1	XC88x
	MISC_CON	E9 _H	0	1	XC88x, XC878
WDT	WDTCON	BB _H	1	-	XC88x, XC878
CORDIC	CD_STATC	A0 _H	1	-	XC88x, XC878
MDU	MDUSTAT	B0 _H	1	-	XC88x, XC878

Functional Deviations
Table 7

Module	Register	SFR Address	RMA P	Page	Products Affected
SSC	CONH (Operating Mode)	AB _H	0	-	All
UART1	SCON	C8 _H	1	-	XC88x, XC878
	FDCON	CC _H	1	-	XC88x, XC878
T2	T2CON	C0 _H	0	-	All
T21	T2CON	C0 _H	1	-	XC88x, XC878
OCDS	MMCR2	E9 _H	1	-	All
	MMCR	F1 _H	1	-	All
	MMSR	F2 _H	1	-	All
	MMICR	F4 _H	1	-	All
T2CCU	CCTCON	C6 _H	0	1	XC878
	COSHDW	C0 _H	0	2	XC878
	COCON	C0 _H	0	3	XC878
	CC0L	C1 _H	0	2	XC878
	CC0H	C2 _H	0	2	XC878
	CC1L	C3 _H	0	2	XC878
	CC1H	C4 _H	0	2	XC878
	CC2L	C5 _H	0	2	XC878
	CC2H	C6 _H	0	2	XC878
	CC3L	C1 _H	0	3	XC878
	CC3H	C2 _H	0	3	XC878
	CC4L	C3 _H	0	3	XC878
	CC4H	C4 _H	0	3	XC878
	CC5L	C5 _H	0	3	XC878
	CC5H	C6 _H	0	3	XC878

Table 7

Module	Register	SFR Address	RMA P	Page	Products Affected
CCU6	CC63SRL	9A _H	0	0	All
	CC63SRH	9B _H	0	0	All
	MCMOUTSL	9E _H	0	0	All
	MCMOUTSH	9F _H	0	0	All
	CC60SRL	FA _H	0	0	All
	CC60SRH	FB _H	0	0	All
	CC61SRL	FC _H	0	0	All

Table 7

Module	Register	SFR Address	RMA P	Page	Products Affected
CCU6 (cont'd)	CC61SRH	FD _H	0	0	All
	CC62SRL	FE _H	0	0	All
	CC62SRH	FF _H	0	0	All
	T12PRL	9C _H	0	1	All
	T12PRH	9D _H	0	1	All
	T13PRL	9E _H	0	1	All
	T13PRH	9F _H	0	1	All
	T12DTCL	A4 _H	0	1	All
	T12DTCH	A5 _H	0	1	All
	TCTR0L	A6 _H	0	1	All
	TCTR0H	A7 _H	0	1	All
	T12MSELL	9A _H	0	2	All
	T12MSELH	9B _H	0	2	All
	IENL	9C _H	0	2	All
	IENH	9D _H	0	2	All
	INPL	9E _H	0	2	All
	INPH	9F _H	0	2	All
	PSLR	A6 _H	0	2	All
	MCMCTR	A7 _H	0	2	All
	TCTR2L	FA _H	0	2	All
	TCTR2H	FB _H	0	2	All
	MODCTRL	FC _H	0	2	All
	MODCTRH	FD _H	0	2	All
	TRPCTRL	FE _H	0	2	All
	TRPCTRH	FF _H	0	2	All
	PISEL0L	9E _H	0	3	All
	PISEL0H	9F _H	0	3	All
	PISEL2	A4 _H	0	3	All

Table 7

Module	Register	SFR Address	RMA P	Page	Products Affected
CCU6 (cont'd)	T13L	FC _H	0	3	All
	T13H	FD _H	0	3	All
	CMPSTATH	FF _H	0	3	All
ADC	GLOBCTR	CA _H	0	0	All
	PRAR	CC _H	0	0	All
	LCBR	CD _H	0	0	All
	INPCR0	CE _H	0	0	All
	ETRCR	CF _H	0	0	All
	CHCTR0	CA _H	0	1	All
	CHCTR1	CB _H	0	1	All
	CHCTR2	CC _H	0	1	All
	CHCTR3	CD _H	0	1	All
	CHCTR4	CE _H	0	1	All
	CHCTR5	CF _H	0	1	All
	CHCTR6	D2 _H	0	1	All
	CHCTR7	D3 _H	0	1	All
	RCR0	CA _H	0	4	All
	RCR1	CB _H	0	4	All
	RCR2	CC _H	0	4	All
	RCR3	CD _H	0	4	All
	CHINPR	CD _H	0	5	All
	EVINPR	D3 _H	0	5	All
	CRCR1	CA _H	0	6	All
	CRPR1	CB _H	0	6	All
	CRMR1	CC _H	0	6	All
	QMR0	CD _H	0	6	All

Functional Deviations

For example, in the sample code below, there are two MOV (direct, direct) instructions that write the value of one register into another. All the source and destination registers in these two instructions are from the direct address range 80_H to FF_H.

The P1_DATA register is not one of the affected registers listed in the table above and therefore, it is written with the correct value of the CC60SRL register. On the other hand, the CC60SRH register is one of the affected registers and therefore, it is written with the wrong value of the B register.

Sample Code:

```
interrupt:
MUL A, B
MOV CC60SRL, A
MOV P1_DATA, CC60SRL
MOV CC60SRH, B
RETI
```

Workaround

Instead of using the MOV (direct, direct) instruction, use other instructions or an intermediate variable to write to the targeted register.

For example, the two MOV (direct, direct) instructions in the earlier sample code can be replaced with MOV (direct, A) instructions (hex code F5_H). Both the P1_DATA and CC60SRH registers will now be written with the correct source register values.

Sample Code:

```
interrupt:
MUL A, B
MOV CC60SRL, A
MOV P1_DATA, A
XCH A, B
MOV CC60SRH, A
RETI
```

T2_XC8.001 Timer 2 is not suspended during debug in counter mode

Timer 2 is not suspended (even if Timer 2 suspend control is enabled by setting bit MODSUSP.T2SUSP) during debug if Timer 2 is set to counter mode.

Workaround

None.

UART_XC8.001 Bits RB8, TI and RI in UART1_SCON SFR cannot be Written by SETB, CLR and CPL Instructions

The bits RB8, TI and RI in UART1_SCON SFR, which is a bitaddressable SFR, are not updated when written with SETB, CLR and CPL instructions. As a result, the UART1 module is not fully compatible with standard 8051 code.

Workaround

Use MOV bit,C instruction to write to the bits RB8, TI and RI in UART1_SCON SFR or target the write access on the whole register.

UART_XC8.002 Bits FDEN and FDM in UART1_FDCON SFR cannot be Written by Read-Modify-Write Instructions

The bits FDEN and FDM in UART1_FDCON SFR are not updated when written with the read-modify-write instructions listed in the table below:

Table 8

Affected Read-Modify-Write Instructions	Hex Code
INC dir	05
DEC dir	15
ANL dir,A	52
ANL dir,#data	53
ORL dir,A	42

Table 8

Affected Read-Modify-Write Instructions	Hex Code
ORL dir,#data	43
XRL dir,A	62
XRL dir,#data	63
XCH A,dir	C5
DJNZ dir,rel	D5

Workaround

Use MOV instructions, except MOV dir, dir (Hex Code: 85), when writing to the bits `FDEN` and `FDM` in `UART1_FDCON` SFR.

3 Deviations from Electrical- and Timing Specification

4 Application Hints

ADC_AI.H001 Arbitration Mode with disabled Arbitration Slots

In arbitration mode (bit ARBM = 1_B in register PRAR), the arbiter only runs while at least one conversion request is pending, otherwise it waits in an idle state for a request to become active. This leads to a constant and reproducible latency from an incoming request to the conversion start.

Each request source x ($x = 0, 1$) can be individually selected (via the Arbitration Slot Enable bits ASEN_x in register PRAR) to take part in the arbitration round. However, if a disabled request source (bit ASEN_x = 0_B) has a pending request, the related conversion is not started, but the arbiter does not stop and wait. As a result, the latency for requests generated on other arbitration slots is not constant.

To avoid this effect, first disable the request generation of the respective source by setting bit ENGT = 0_B in the corresponding register QMR0 or CRMR1 before disabling the arbitration slot via ASEN_x = 0_B.

ADC_XC8.H001 Arbitration mode when using external trigger at the selected input line REQTR

If an external trigger is expected at the selected input line REQTR to trigger a pending request, the arbitration mode should be set (PRAR.ARB=1) where the arbitration is started by pending conversion request. This selection will minimize the jitter between asynchronous external trigger with respect to the arbiter and the start of the conversion. The jitter can only be minimized while no other conversion is running and no higher priority conversion can cancel the triggered conversion. In this case, a constant delay (no jitter) has to be taken into account between the trigger event and the start of the conversion.

BROM_XC8.H001 SYSCON0.RMAP handling in ISR

The ISR has to handle SYSCON0.RMAP correctly when Flash user routines provided in the Boot ROM are used together with the interrupt system. Any ISR with the possibility of interrupting these user routines has to do the following in the interrupt routine:

save the value of the RMAP bit at the beginning

restore the value before the exit

This is to prevent access of the wrong address map upon return to the Flash user routine since the RMAP bit may be changed within the interrupt routine. The critical point is when Flash user routines sets RMAP to '1' and the interrupt occurs that needs RMAP at '0' in the ISR.

Please note that NMI is an interrupt as well.

BROM_XC8.H002 Obtain Product Derivative Information With Chip Identification Number

The chip identification number is a unique 4-byte data that is assigned to each product derivative based on the following differentiations:

- product
- variant type
- device-step

Therefore, to identify a product derivative, the number can be obtained and matched to a list of product derivatives and their corresponding numbers, which can be found in the latest product data sheet.

The number is read using the in-application user subroutine, GET_CHIP_INFO, or BSL mode A. Description on the usage of GET_CHIP_INFO and BSL mode A can be found in the latest user's manual.

CCU6_XC8.H002 CCU6 PM event in center-aligned mode

After detecting a period match (PM A) in centre-aligned mode, T12 counts down from PM + 1 as shown below:

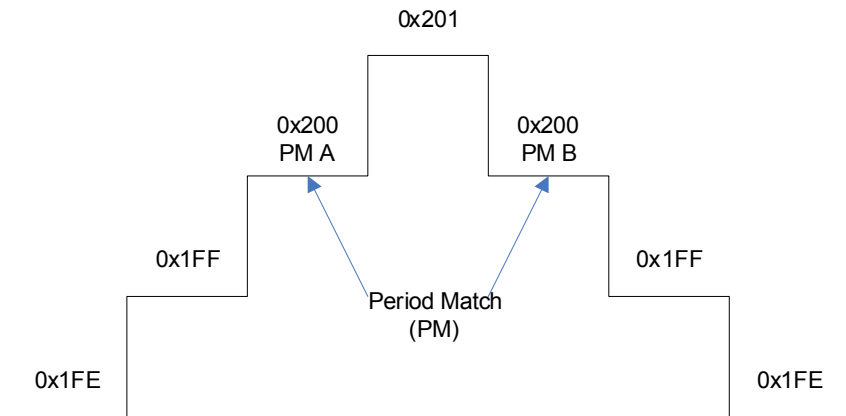


Figure 4 Counting sequence of T12 in center-aligned mode

This means a second PM event (PM B) will occur during the counting down. If ADC is triggered externally via ETRx2 (T12PM), it will be triggered twice in succession. Depending on how real-time the application code is running as well as the T12 count rate and ADC conversion rate, the application could observe two ADC interrupts - once at PM A and once at PM B.

To avoid triggering twice the ADC interrupts, it is suggested to use ETRx6 from multi-channel mode instead of ETRx2 as the trigger source for ADC. Additional initialization are as follows:

- Configure MCMCTR.SWSEL = 101_B (Transfer on T12 period match)
- Configure MCMCTR.SWSYN = 00_B (Direct transfer)
- Write to MCMOUTSTL = CF_H (To enable multi-Channel PWM pattern on CC6x and COUT6x)

Note: Independent of the external trigger, the CCU6 internal triggers based on T12 PM (e.g. T12 PM interrupt or shadow transfer) are only activated once while T12 is counting up.

FLASH_XC8.H002 Programming to invalid P-Flash address range 5000_H to 5FFF_H may corrupt existing P-Flash data

For the 24-KByte Flash variant, writing to the unavailable program memory addresses from 5000_H to 5FFF_H can lead to corruption of existing data in the valid P-Flash addresses from 4000_H to 4FFF_H.

The user has to make sure not to write to the addresses from 5000_H to 5FFF_H.

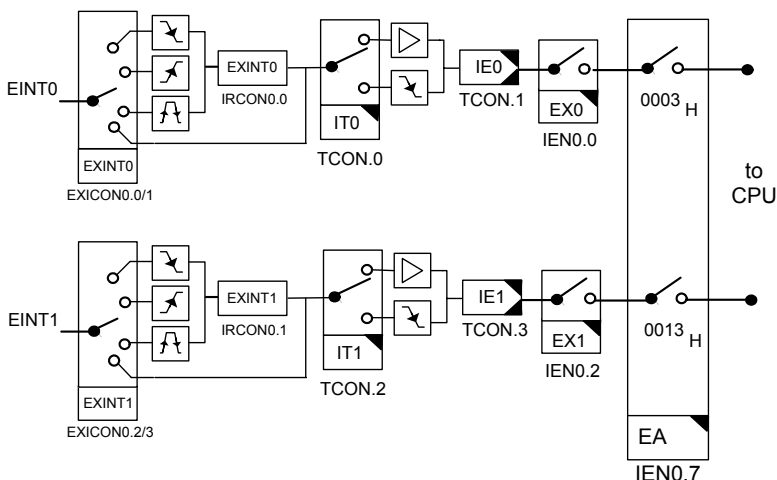
FLASH_XC8.H003 Verify if a Flash program or erase operation is successful

The Flash memory cannot be programmed or erased under a PLL loss-of-lock condition. In the Boot ROM program and erase routines, the Boot ROM checks that the PLL NMI flag `NMISR.FNMIPLL` is zero to ensure no PLL loss-of-lock has occurred before starting the program or erase sequence. If the PLL NMI flag is set, the Boot ROM will set the carry flag `PSW.CY` and exit the routine without starting the program or erase sequence.

A manual check on the Flash data or the carry flag is necessary to determine if the program or erase operation is successful.

INT_XC8.H003 Interrupt Flags of External Interrupt 0 and 1

External interrupt 0 and 1 may individually be selected via respective bits (`EXINTx`) in `EXICON0` register, to request interrupt on falling edge, rising edge, both edges or to bypass the edge detection.


Figure 5

Edge detection is done in the system unit. If enabled, an active event will set the `EXINTx` flag and correspondingly set the `IEx` flag in `TCON`. It should be noted that after any external interrupt `x` event, flag `EXINTx` must be cleared. In case of falling edge as active event, this allows any future active event to be able to set the flag `IEx` as interrupt request. In case of low level as active event, this prevents unintended recurring triggering of interrupt request.

Besides the above notes, the following should be noted on the behavior regarding setting and clearing of the external interrupt `x` (`x = 0` or `1`) flags, applicable to both edge and bypass edge detection modes:

Setting of External Interrupt `x` Flags

1. The flag `TCON.IEx` will be set in all modes selectable via `EXICON0` register.
2. Flag `IRCON0.EXINTx` will be set in all modes as long as an active edge is detected; flag `EXINTx` will not be set for low level as active event.

Clearing of External Interrupt x Flags

1. Flag `IEx` is cleared automatically by hardware when the interrupt is being vectored to.
2. Flag `EXINTx` has to be cleared by software.
3. Clearing one external interrupt x flag will not clear the other. Especially, clearing flag `EXINTx` will not clear the flag `IEx`. Being of interrupt structure 1, the flag `IEx` is the request polled by the CPU for interrupt servicing. Therefore user has to take care to clear the flag `IEx` before switching from SW polling method to enabling the external interrupt x node, to prevent potential dummy interrupt request.
4. Always clear both `EXINTx` and `IEx` flags before (if) changing the trigger select in `EXICON0` register.

INT_XC8.H004 NMI Interrupt Request With No NMI Flag Set

It might occur in the application, that sometimes NMI interrupt requests are serviced, but no active NMI interrupt flags are found.

Consider the following NMI interrupt service routine pseudo-code, and scenario where a NMI interrupt source A event leads to interrupt request of the NMI node and CPU vectors to the NMI interrupt routine. Meanwhile, NMI interrupt source B and its flag becomes active any time in the duration indicated by T:

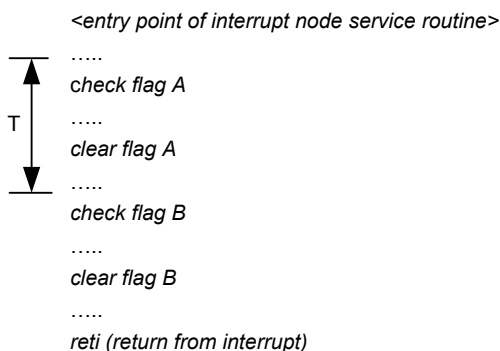


Figure 6

In this case, NMI flag B will be cleared as a standard procedure by the NMI interrupt routine in the current service. However, the pending interrupt request for the NMI node remains activated after RETI, as it is only cleared by hardware when CPU acknowledge the NMI interrupt and vectors to the NMI service routine.

This leads to following servicing of the NMI interrupt node again, but potentially no active NMI flag is found, i.e. dummy NMI interrupt service. The point to note is that the NMI interrupt source B is not lost, as it was actually serviced in the current service of the NMI interrupt node.

The recommendation is to ignore these dummy NMI interrupt vectoring.

INT_XC8.H005 Not all Flags are qualified for clearing Pending Interrupt Request

For interrupts of structure 2, qualified event (status) flags are used for clearing any pending interrupt request to the core. An event flag is qualified as long as the event is enabled for interrupt. By this means, as long as all qualified flags of the node are cleared, any still active pending interrupt request to the core will be cleared by hardware.

However with existing implementation, not all event flags are qualified for clearing the pending interrupt request to core. These flags are listed in the following table, corresponding to the interrupt node the flag belongs to.

Table 9

Interrupt Node	Vector Address	Assignment	Unqualified Flags Belonging to Node
NMI	0073 _H	Watchdog Timer NMI	NMIWDT
		PLL NMI	NMIPLL
		Flash NMI	NMIFLASH
		OCDS NMI	NMIOCDS
		VDDC Prewarning NMI	NMIVDD
		VDDP Prewarning NMI	NMIVDDP
		Flash ECC NMI	NMIECC

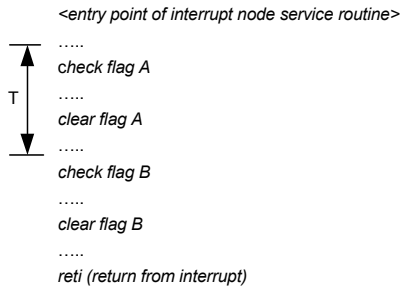
Table 9

Interrupt Node	Vector Address	Assignment	Unqualified Flags Belonging to Node
XINTR5	002B _H	LIN	EOFSYN, ERRSYN
XINTR8	0043 _H	External Interrupt 2	EXINT2
		CORDIC	EOC
		UART1	RI, TI
		UART1 Fractional Divider (Normal Divider Overflow)	NDOV
		MDU	IRDY, IERR
XINTR9	004B _H	External Interrupt 3	EXINT3
		External Interrupt 4	EXINT4
		External Interrupt 5	EXINT5
		External Interrupt 6	EXINT6

Note: Some events e.g. TF2, EXF2 of Timer 2, Timer21; NDOV of UART; NDOV, RI and TI of UART1 do not have separate interrupt enable apart from its interrupt node enable. These event flags are therefore always qualified, if the interrupt node is enabled.

Consider the case where an enabled interrupt node is shared by more than 2 events, and where at least two of the events (A and B) are enabled for interrupt while at least one event (C) is not enabled for interrupt. In this case, flag C is one of the flags listed in above table.

While the interrupt routine is already running due to event A having occurred, event B and C occurs any time in the duration indicated by T:


Figure 7

This sets the pending interrupt request while flag B is set. Although event B is serviced and flag B is cleared in the following service routine, on return from interrupt, the pending interrupt request remains activated. This is because event C is not enabled for interrupt (and therefore flag C is neither checked nor cleared in the interrupt routine) while flag C is not qualified. This leads to following servicing of the interrupt node again, but potentially no active flag is found, i.e. dummy interrupt service. To prevent such dummy interrupt vectoring on the above listed interrupt nodes, do not use mixed interrupt servicing and polling scheme, i.e. enable all events of the node for interrupt if interrupt node is enabled. Otherwise if mixed interrupt servicing and polling scheme is to be used, ignore these dummy interrupt vectoring.

LIN_XC8.H001 LIN BRK field detection logic

Based on the hardware implementation, the maximum number of bits in the BRK field must follow the formula:

$$\text{Maximum number of bits in BRK field} = \text{Baud Rate} \times \frac{4095}{\text{Sample Frequency}}$$

$$\text{Sample Frequency} = \frac{\text{PCLK}}{8 \times 2^{\text{BGSEL}}}$$

For example, if LIN baudrate is 19.2kbps, BGSEL = 0 and CPU frequency is 24MHz, the maximum number of bits in BRK field would be:

$$19.2\text{k} \times 4095 / (24\text{M} / 8) = \sim 26.2 \text{ bits}$$

If the maximum number of bits in the BRK field exceeded, the internal counter will overflow which results in baudrate detection error. Therefore, the user is advised to choose the appropriate BGSEL value for the required baudrate detection range.

The calculated value above does not consider sample error and transmission error, nevertheless it can be used as a guideline.

LIN_XC8.H002 LIN Break/Synch field detection

The LIN Break/Synch field detection is default enabled after every reset (BCON.BRDIS bit = 0). However, to ensure the first standard LIN frame can always be detected, it is recommended to initialize the detection logic in the user code before receiving the frame. This is through the following two steps:

1. Toggle BCON.BRDIS bit (set the bit to 1 before clearing it back to 0).
2. Clear the three status flags FDCON.BRK, FDCON.EOFSYN and FDCON.ERRSYN to 0.

It is also recommended to toggle the BCON.BRDIS bit after the reception of each complete LIN frame to avoid a wrong Break field detection in noisy environments (i.e. spikes on the LIN bus).

OCDS XC8.H002 Any NMI request is lost on Debug entry and during Debug

All NMI events are disabled while in debug mode. This has two main effects:

1. On debug entry, any pending NMI request will be lost, although the status flag remains set. The probability of losing an NMI request in this way is very low, since NMI always has the highest priority to be serviced.
2. Any NMI event that occurs during debugging is not able to generate an NMI request (event interrupt is lost) although the status flag will be set. It is normally not critical that on exit from debug mode, the CPU must service NMI requests that had occurred while in debug mode.

The fact that the debug system is not specified to support NMI interrupt while in debug mode makes the above trivial. As precaution, avoid starting any debug session while expecting an NMI event.

PIN XC8.H001 Current over GPIO pin must not source V_{DDP} higher than 0.3V

When V_{DDP} is not powered on, the current over a GPIO pin has to be limited in such a way that $V_{DDP} - V_{SSP} \leq 0.3V$. This prevents the supply of the device via the ESD diode between the GPIO pin and V_{DDP} .

However, for applications with strict low power-down current requirements, it is mandatory that no active voltage source is supplied at any GPIO pin when V_{DDP} is not powered on.

PLL XC8.H001 Check oscillator run bit 2048 VCO cycles after oscillator run detection is restarted.

When performing a loss-of-lock recovery or changing to an external oscillator, one of the steps required is to restart the oscillator run detection logic by setting `OSC_CON.ORDRES` bit to 1.

After the oscillator run detection logic is restarted, the user should wait for minimum 2048 VCO cycles (approximately between 30 μs and 200 μs

depending on VCO base frequency) before checking the status of the oscillator run bit `OSC_CON.OSCR`.

SYS_XC8.H001 Usage of the Bit Protection Scheme

When the bit protection scheme is enabled, bit field `PASSWD.PASS` should always be used to open and close write access to the protected bits. The scheme should be disabled only if it is not required in the application.

In the unlikely event that the scheme is enabled again after disabling it while the write access is still open, the write access will remain open until the count of 32 CCLK cycles is completed.

SYS_XC8.H003 Effective write for Read-Modify-Write instructions of two bytes, one machine cycle

When read-modify-write instructions requiring 2 bytes and 1 machine cycle (equivalent to 2 CCLK cycles) for execution, such as `INC dir`, are executed from memories without any wait states¹⁾, the actual write to the destination is delayed by the internal bus for up to one CCLK cycle. This means that even though the CPU completes the instruction execution after 2 CCLK cycles, the write through the internal bus may take effect only after a further CCLK cycle.

The list of affected read-modify-write instructions is shown below:

Table 10

Mnemonic	Hex Code	Bytes	No. of CCLK cycles (without wait states)
INC dir	05	2	2
DEC dir	15	2	2
ANL dir, A	52	2	2
ORL dir, A	42	2	2
XRL dir, A	62	2	2

1) Applicable also to Flash memory with parallel read feature.

Table 10

Mnemonic	Hex Code	Bytes	No. of CCLK cycles (without wait states)
XCH A, dir	C5	2	2
CLR bit	C2	2	2
SETB bit	D2	2	2
CPL bit	B2	2	2

SYS_XC8.H004 Switch PLL to prescaler mode before a WDT reset

A WDT reset does not reset the clock system. If a WDT reset occurs while the PLL is in base mode (`PLL_CON.OSCDISC = 1`), the system will be held in reset until the next power-on or hardware reset. This is because the system requires the PLL to be locked (`PLL_CON.LOCK = 1`) or in the prescaler mode (`PLL_CON.OSCDISC = 0`; `PLL_CON.VCOBYP = 1`) before the reset can be released.

If the above behaviour is not desired, it is recommended to switch the PLL to prescaler mode, and with the on-chip oscillator as the input clock source (`OSC_CON.OSCSS = 0`), whenever a WDT prewarning is entered.